

Autonomous High-Resolution Low-Light Color Video Camera Systems User's Manual



National Marine Fisheries Service
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Purpose of the Loaner Video Camera Systems

The purpose of these loaner video camera systems is to provide trawl and fixed gear fishermen with equipment for evaluating industry-designed approaches to reduce bycatch and reduce impacts to benthic habitats.

Camera System Components



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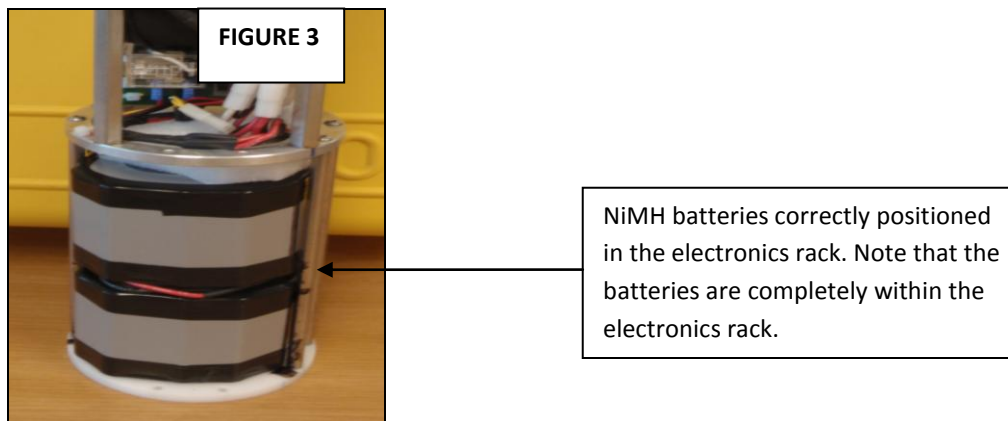
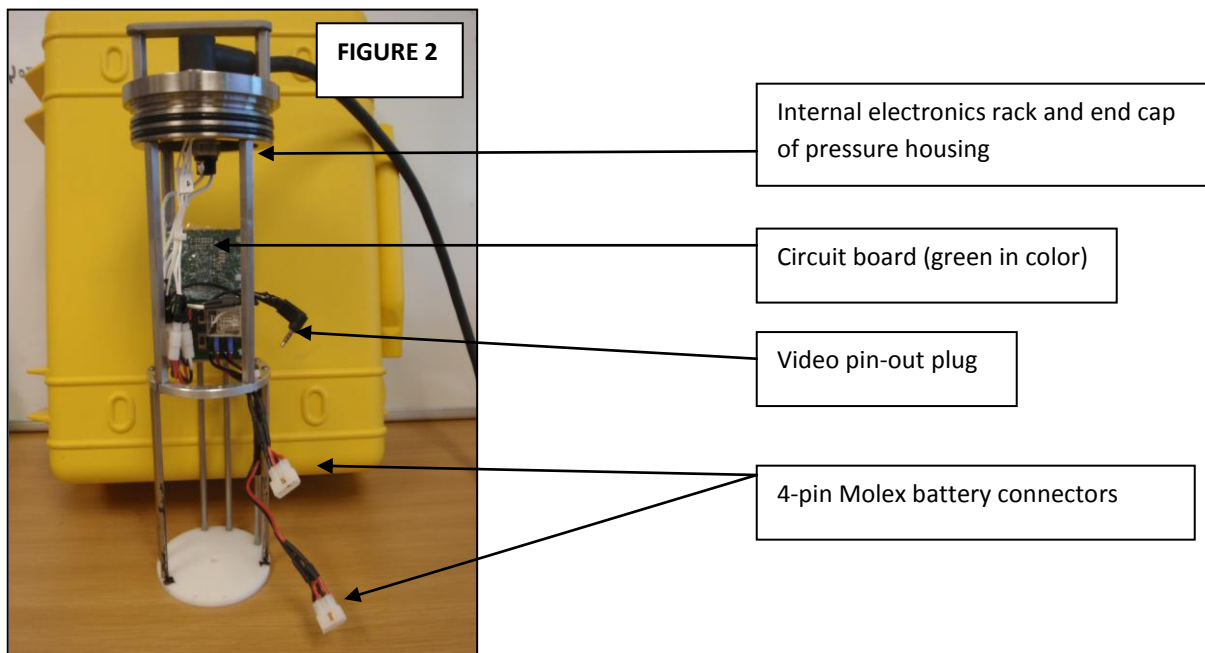
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Steps and Procedures for Starting and Deploying the Video Camera System

1. Place two fully charged NiMH batteries (Figures 1 and 8 show a NiMH battery) into their position in the electronics rack. Plug-in the batteries to the 4-pin Molex battery connectors (Figure 2). It is not necessary to plug in the 2-pin Molex connectors on the batteries at this point in time.

NOTE: When connecting the first NiMH battery into one of the 4-pin Molex connectors, the other 4-pin Molex connector will become “hot/live” as power is running through the circuit board. To avoid blowing a fuse on the circuit board or damaging the 4-pin Molex connector, avoid contact with any object other than a NiMh battery with the 4-pin Molex connector.

NOTE: Because of the shape and size of these batteries, there is only one correct position that the batteries can be placed into the electronics rack (Figure 3).



2. Make sure that a battery and memory card (SD HC) are present in the DVR device and that the white tab on the SD memory card is set in the forward/upmost position. Figure 1 shows the DVR device and Figure 9 shows the SD HC memory card.
3. Turn the “Off/TV/LCD” switch to “Off” on the DVR device.
4. If the DVR device is turned on, turn the Power “Off/On/Rec” switch to “Off.” Wait until the blue LED light turns off before proceeding to step 5.
5. Turn the Power “Off/On/Rec” switch to “Rec” on the DVR device.
6. Connect the video pin-out plug from the circuit board (green colored device) into the “12V Cam In” jack on the DVR device (Figure 2). The DVR device display screen will say “No Signal.” *This is normal.*
7. Place the DVR device into its position in the electronics rack and proceed to close and seal the pressure housing for deployment.

NOTE: Make sure that there are no wires hanging outside of the electronics rack that could get pinched or cut when the frame is placed into the pressure housing (Figure 4). Also, make sure that when securing the pressure housing that the plastic keeper rod is inserted into its locking groove (Figure 5).

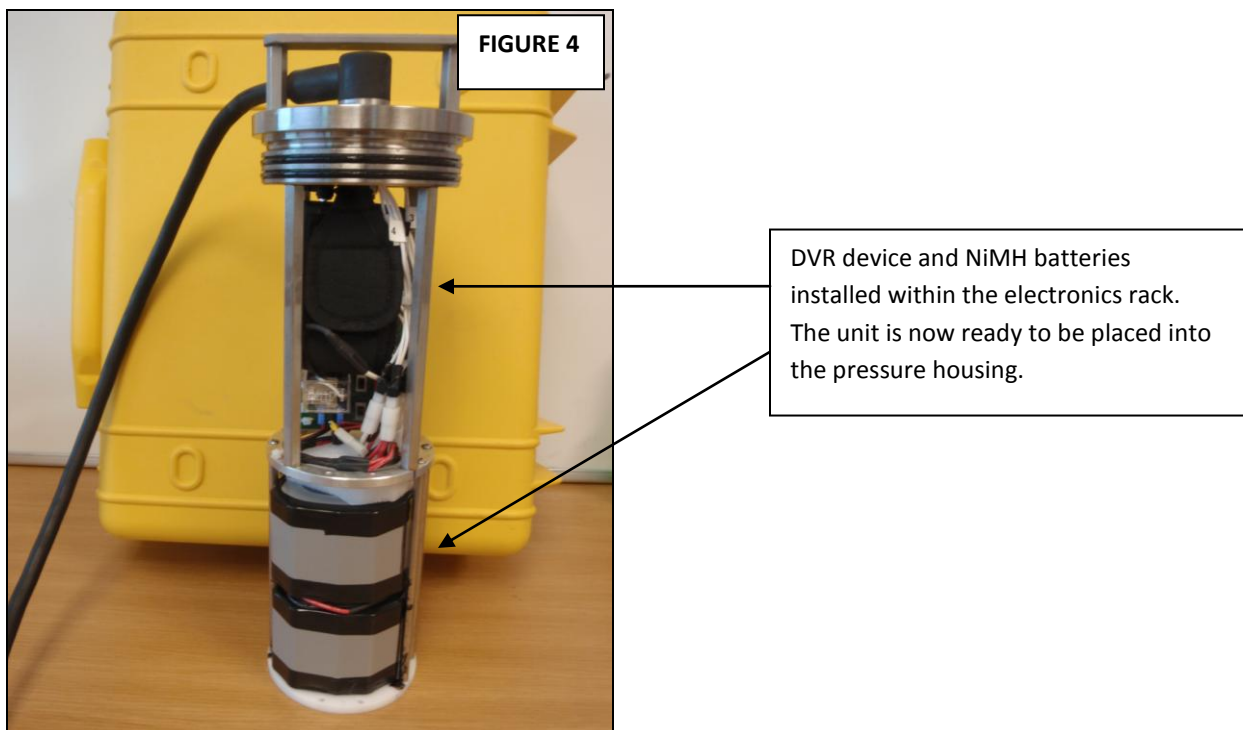




FIGURE 5

Assembled pressure housing with plastic keeper rod in place.

Plastic keeper rod

8. Connect the wiring harness from the pressure housing to the camera-light wiring harness (Figure 6).

NOTE: After connecting the plugs together, wrap the connection with a modest amount of electrical tape (3 or 4 wraps). This will help keep the two plugs together.



FIGURE 6

Connect these two wiring harness plugs together.

9. The camera system is now ready for use and will begin recording when it has been deployed and the pressure switch has been activated, which occurs around 6 to 32 fathoms, depending on the pressure switch setting.

Steps and Procedures for Retrieving and Viewing the Video Camera Systems

Footage

1. If possible rinse off the pressure housing with freshwater and dry the outside of tube as best as possible.
2. In a secured dry area, open the pressure housing.

NOTE: When opening the pressure housing be very careful not to get water on any of the systems components. Although the system is out of the water and in a dry secure area, there will still be small amounts of water on and around the external parts of the pressure housing.

3. Remove the DVR device from the electronics rack and unplug the video plug from the “12V Cam In” jack on the DVR device. The DVR device display screen will again say “No Signal.” *This is normal.*
4. Turn the Power “Off/On/Rec” switch from “Rec” to “Off.” Wait until the red and blue LED light turns off before proceeding to step 5.
5. Turn the “Off/TV/LCD” switch to “LCD” on the DVR device.
6. Turn the Power “Off/On/Rec” switch from “Off” to “On.”
7. On the DVR device display screen, on the “Main Menu” the video footage will be stored under “video files.”
8. To view footage, push the “enter” button on the “video files” folder. A folder called “my record” will appear. Push the “enter” button again and it will take you to the collected video footage. Press the return button once more to view the footage.

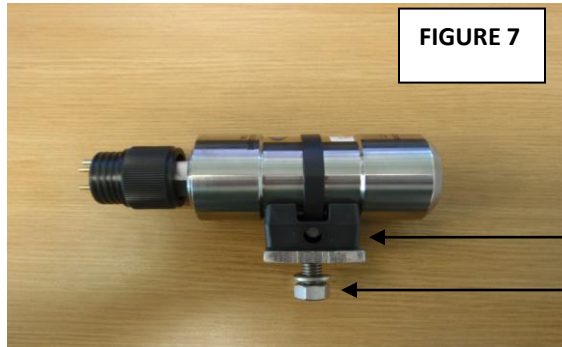
NOTE: This DVR device stores its information in 30 minute files. If a tow is longer than 30 minutes, there will be multiple files for that tow.

9. To watch footage on a TV, connect the RCA plug to the “AV Out” jack and switch the “Off/TV/LCD” switch to “TV.” To watch it on a computer use the USB cable.

Positioning the Video Camera

On the video camera there is a “T” symbol above the lettering “Multi-SeaCam” (Figure 7). This symbol (T) depicts the cameras right-side-up orientation. Failure to orient the camera in its correct position will result in video footage being displayed sideways or upside down. These video cameras are designed so the orientation can be adjusted. To change the orientation of the camera with regard to its axis, loosen the hose clamp at the base of the camera and then adjust accordingly. To change the vertical orientation of the camera, loosen the nut that attaches the

camera's plastic bracket to the aluminum "turret" and then adjust accordingly. If one would like to change the horizontal orientation of the camera, loosen the four SS bolts that attach the camera turret to the UMW mounting board and rotate the camera. The light turret may require a similar set of adjustments to properly illuminate the field of view of the video camera.



Loosen the hose clamp here to change the horizontal orientation of the video camera.

Loosen the bolt nut here to change the vertical orientation of the video camera

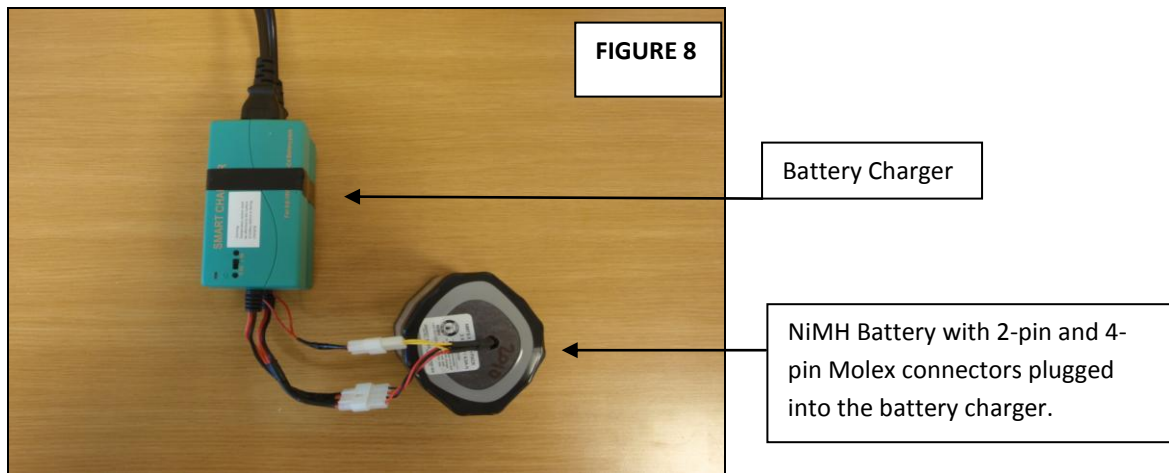


" T " symbol showing where the right side up orientation of the video camera is.

Charging of NiMH Batteries

1. Plug in the NiMH battery charger and set both sides of the charger to the same charge rate (1.8A or 0.9A). 1.8A will charge the battery at a faster rate than 0.9A.
2. Connect the NiMH battery and NiMH battery charger Molex connectors together (Figure 8). The 2-pin Molex connector monitors the temperature of the batteries. The 4-pin Molex connector charges the battery. When the light turns green the battery is fully charged. If these batteries become overheated the charger will shut down. These battery chargers will also reduce the charging rate to a trickle once the battery has become fully charged so there is no worry about overcharging them.

NOTE: When the batteries are fully charged they should read-out at about 14.5 to 15.0 VDC on a voltmeter. If the batteries read-out at around 13.5 VDC, they are very close to being drained of all of their energy and need to be recharged.



NiMH Battery Life / Duration

The rate of discharge of the NiMH batteries will depend on which light source is used. The more power the light draws the shorter in duration the batteries will last. Using the halogen light (Figure 12) with a 20 W bulb or the LED Mini-Sealite® (long narrow/skinny light, 24 W but equivalent to a 100 W halogen bulb) will provide the longest battery life duration if the batteries are fully charged when used/deployed. If the batteries are fully charged, one should be able to record video footage for at least 3 hours using these particular lights. Using the halogen light with a 50 W bulb or the large LED Multi-SeaLite® Matrix will draw the most power and result in the shortest battery life. Using these particular lights, one should be able to record video footage for at least 1 hour.

NOTE: At full battery charge, the DVR device can only record up to 3 hours of video footage.

Charging the DVR device Battery and its Battery Life/Duration

In the toolbox there is a rectangular black cardboard box containing various accessories, including an AC/DC adaptor and an external battery charger for charging the battery. The adaptor can be plugged into the DVR to charge the battery or you can remove the battery from the DVR and charge it using the external battery charger. When the battery is fully charged, the charging light will go out.

NOTE: When these batteries are fully charged the system will record footage for up to 3 hours. Also, the “pull” tab on the battery is for removing the battery from the DVR device itself, NOT for removing the protective covering that is on the battery.

DVR Lexar Professional SD HC Memory Card

On the Lexar memory chip there is a white tab on the outer edge of the card near lettering “Lexar.” To ensure that video footage will be recorded onto the memory card make sure that the white tab is in the forward/upmost position (Figure 9).

NOTE: If the white tab is not in the forward/upmost position no video footage will be recorded onto the memory card.

The white tab is set in the forward/upmost position in this diagram.



Additional Video Camera Features

These video camera systems are designed with the option to bypass the pressure switch, which turns the camera and lights on and off. When the pressure switch is in use, it turns the system on between 6 and 32 fathoms depending on the pressure switch setting. To bypass the pressure switch and turn the lights and camera on while on the vessel's back deck, switch two setting on the circuit board. First, push the "camera" and "light" switch settings on the circuit board away from the "relay" setting. See Figure 10 for an example. After configuring the circuit board settings to the desired specification, follow the "Steps and Procedures for Starting and Deploying the Video Camera System" (pages 4-6) to start and deploy the camera system.

NOTE: When bypassing the pressure switch turn the camera system off when finished recording and then the footage can be viewed. To turn the camera system off, push the "camera" and "light" switches on the circuit board back towards the "relay" setting. Or, simply unplug the two NiMH batteries.

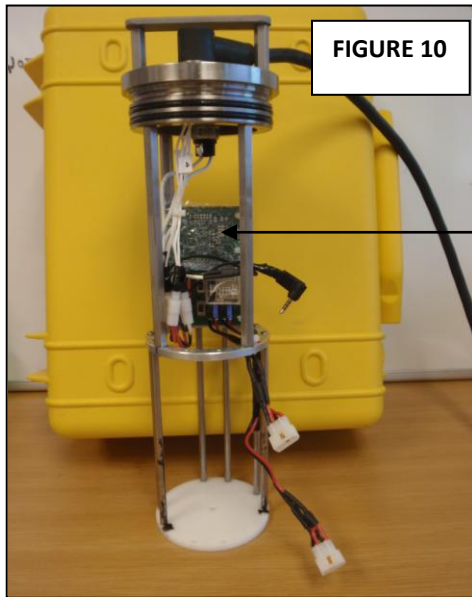


FIGURE 10

Here is where the circuit board is located in the electronics rack (green colored rectangular plastic device)

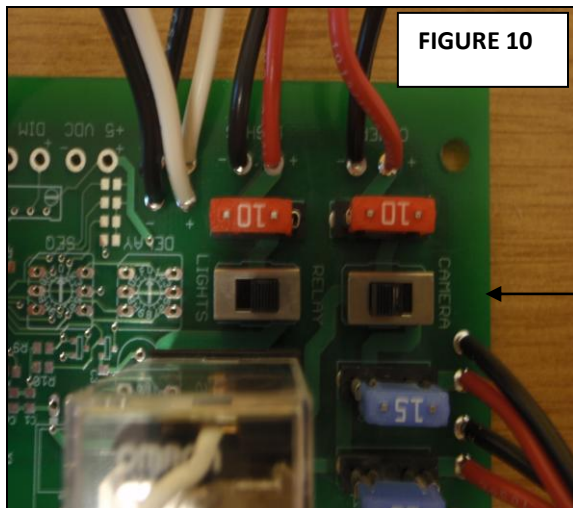


FIGURE 10

Here the "camera" and "light" switches on the circuit board are set /pushed towards the "Relay" setting which would operate the camera system off of the pressure switch. This setting will not record footage in depths shallower than 32 fathoms (depending on the depth setting for the pressure switch).

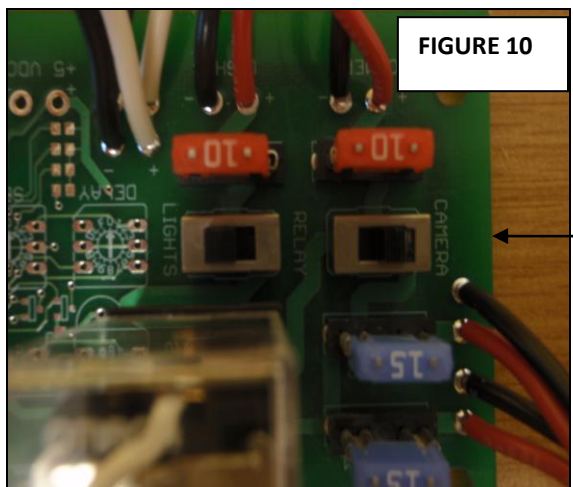


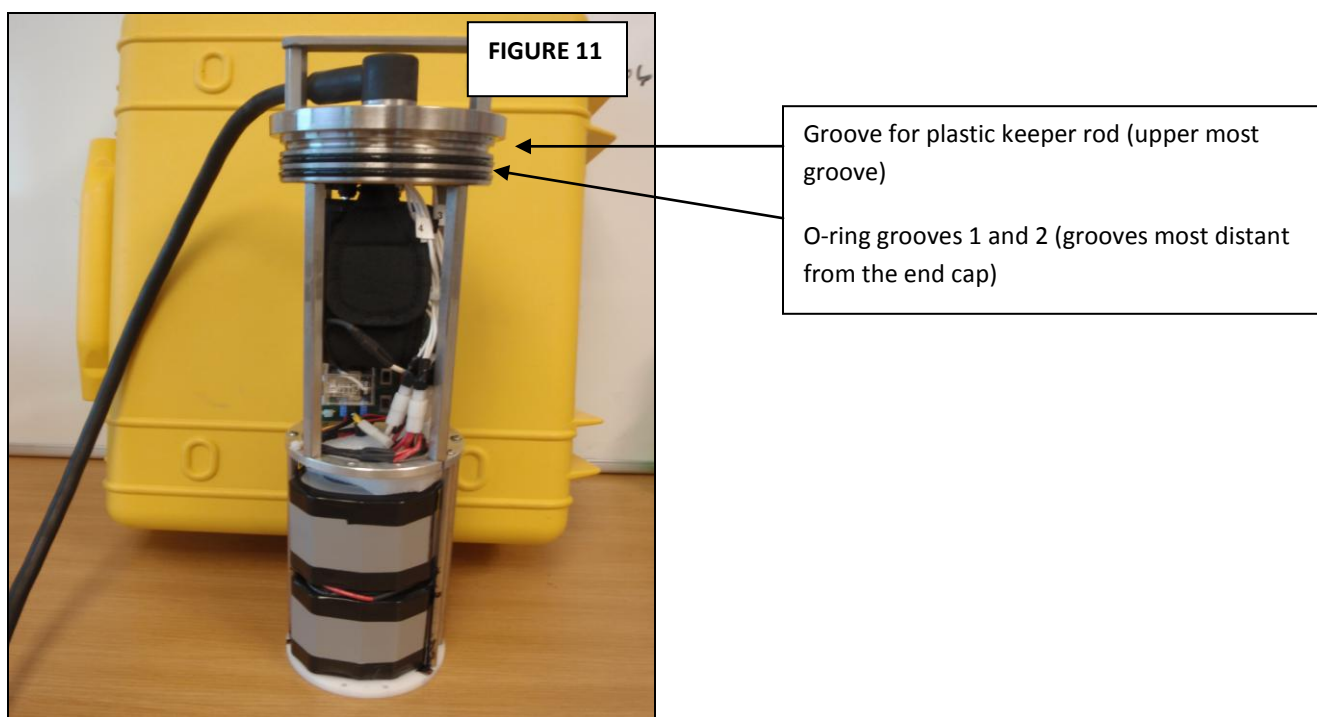
FIGURE 10

Here the "camera" and "light" switches on the circuit board are set /pushed away from the "Relay" setting which would bypass the pressure switch and allow one to turn the camera on on the vessel's back deck. This setting will record the entire time that the camera system is plugged in and will not be turned on or off by the pressure switch.

Routine Maintenance, Care, and Use

O-ring maintenance: One of the most important things to keep maintained on these camera systems is the pressure housing O-rings. If the O-rings appear cracked or have sand, mud or other material contents on them beside O-ring lubricant, or they appear to be in poor condition they should be replaced. Also be aware that sometimes small shavings of plastic from the plastic keeper rod may come in contact with the O-rings when the plastic keeper rod is removed and the system is being opened. If these shavings are present remove them and carefully inspect the O-rings. When in doubt of an O-rings condition, replace that O-ring. Spare O-rings and O-ring lubricant are provided in the loaner tool box kit. When lubricating the O-rings make sure not to apply too much lubricant, as this can lead to the O-rings failing. Put just enough lubricant on them so that they entire O-ring has a light shining layer of lubricant and that they can also move without friction in the O-ring grooves.

NOTE: there are three circular grooves on the pressure housing's end cap. A single O-ring goes into each of the “lower” two most grooves (most distant from the end cap). The keeper rod rides in the upper most groove (Figure 11).

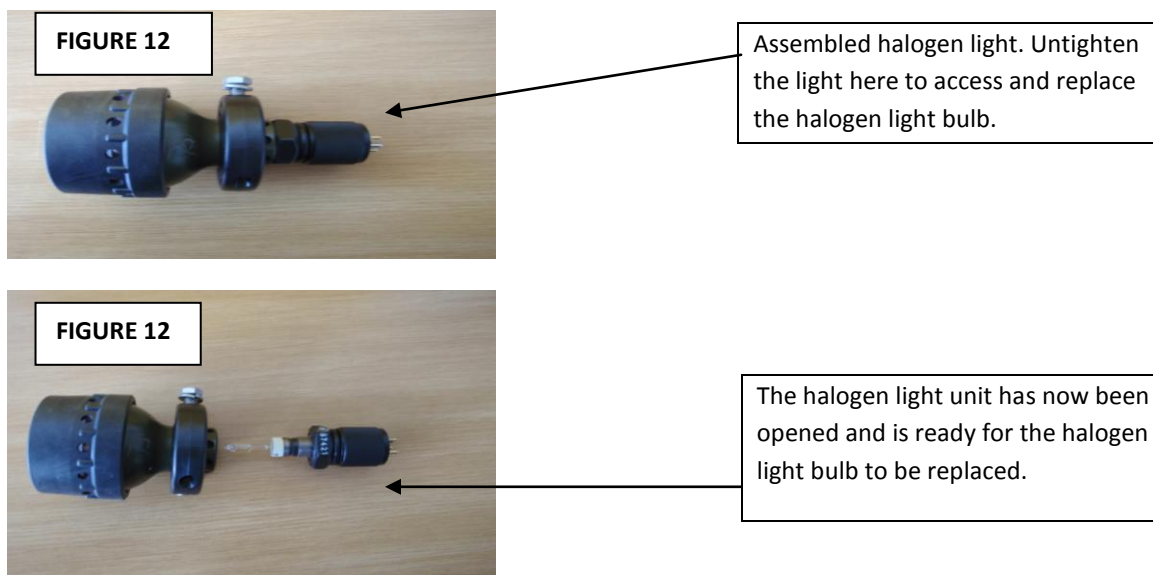


NiMH Battery Maintenance: When using the NiMH batteries make sure that the protected sleeve (heat shrink plastic, grey in colored) is in good condition. If the protective sleeve becomes worn down or cracked, a green colored sleeve will be visible underneath it. To protect this battery sleeve from further degradation cover this area of the battery with electrical tape, which is provided in you loaner tool box. This degrading of the plastic sleeve generally occurs on the top and bottom portions of the battery.

NOTE: Excessive use of electrical tape will increase the diameter of the battery and may make it difficult or impossible to position the battery in the electronics rack. If the grey and green protective sleeves are damaged and metal is showing **do not** use the battery.

Routine care of the Multi-SeaLite® (halogen bulb light fixture): Always check to make sure that the rear bulkhead connector assembly (mail plug) is secure before deployment. Check for condensation inside the glass dome, especially after changing lamps. If any condensation is evident, unscrew the connector/socket assembly from the body and remove the lamp. Place the connector/socket assembly and lamp inside a warm oven (212 deg F) for at least 30 minutes to bake out any moisture that may be present.

Changing / Replacing the Halogen Light bulb: To change a burned-out bulb or to replace the existing bulb with a different wattage, unscrew the socket/connector assembly from the back of the light body and remove the old bulb (Figure 12). When handling and installing the new halogen bulb do not touch the bulb with fingers or anything that may have a grease residue or the bulb will burn out when turned on. Using a Kimwipe or paper towel to handle the halogen light is recommended. When putting the light back together, make sure that the light's O-ring is clean, lubricated, and in its proper position. Also, the light should tighten back together only hand tight; **DO NOT** tighten the light together using a wrench.



Wet Mateable Connectors on Wiring Harnesses / Whips / Camera and Lights: Make sure that all pins on the connectors are clean. Before plugging in the connectors apply a very small amount of lubricant to the rubber section of the male pins. This will ensure a good connection. Once the pigtail from the pressure housing has been connected to the wiring harness leading to the camera and lights (Figure 6), wrap the mated connectors with a small amount of electrical tape. This is to help keep the two plugs together (this type of neoprene connector becomes more

secure with increasing water pressure/depth). When plugging in the camera and light, make sure that the integrated plastic locking sleeves are used to secure the connectors.

Angle of Wiring Harness on the End Cap of the Pressure Housing: On the top of the pressure housing there is a penetrator (w/ cable pigtail) that comes out underneath the end cap handle. **Do not** adjust or move the angle of this device as doing so will either damage the wiring harness or break the O-ring seal and result in the pressure housing being flooded with water.

Amount of Slack to Leave in the Wiring Harnesses / Whips: When placing the camera system in the trawl gear make sure that there is enough slack in the wiring harness so that when the net spreads open, it does not rip apart the two connected plugs (Figure 6). If these plugs are disconnected underwater, there is a very high probability that the camera system will be damaged and require technical repair. Also, make sure not to leave too much slack and increase the risk of having the wiring harness become snagged on something.

Trouble Shooting

The lights are not working: If the light is not working these are some things to check:

1. Check the circuit board to make sure that the 10 amp light fuse (shown in Figure 10) has not blown. If the fuse is blown, replacement fuses are provided for you in your toolbox.

Note: Any repair/maintenance on the LED lights must be done at the factory.

2. If one is using a halogen light, look to see if the halogen light is burned-out. If the halogen bulb is burned-out, replacement bulbs are provided for you in your toolbox. See Figure 12 for instructions on how to change the halogen bulb. Check for condensation inside the glass dome, especially after changing lamps (see above).

The DVR device did not record or if it recorded but no image is present (black screen): If the DVR device did not record these are some things to check:

1. The position of the white tab on the memory chip (Figure 9). If the white tab is set in the down/bottommost position, no video footage will be recorded onto the memory chip.
2. The battery voltage (Figure 8). Make sure that before each deployment that the battery in the DVR device and the NiMH batteries have sufficient battery power.
3. The connection of the video input plug (Figure 2). If this plug is not pushed in all the way or has come partially out of the 12V Cam In port, no video footage will be recorded.
4. The fuses on the circuit board (shown in Figure 10). Check the 10 amp fuse that powers the camera. If this fuse has blown no video footage will be transferred to the DVR device. Also check the 15 amp fuses on the circuit board (fuses for the NiMH batteries).
5. Make sure that DVR device is turned completely off before turning it the record setting. If the DVD device has not been turned off completely before setting it to record, it may not record properly.

Steps to conduct a bench test:

1. In a dry and protected area, connect the entire video camera system together as if it was going to be deployed but without closing and sealing the pressure housing.
2. With the DVR device and batteries connected, set the circuit board system to bypass the pressure switch setting (see Figure 10 for instructions on how to do this). Next, when connecting the two wiring harness together (see Figure 6), if everything is working correctly, the lights and camera will come on, and the DVR device will begin recording. During this bench test you want to set the DVR device “Off/TV/LCD” switch to “LCD.” This will allow you to see the footage on the DVR device display screen.

CAUTIONS: PLEASE READ CAREFULLY

These pressure housings are designed to withstand submerged pressure to 546 fathoms in sea water. If a leak should occur at depth and the housing becomes pressurized, or the batteries become shorted and produce gas and pressurize, the pressure housing can potentially become a bomb.

Take extreme caution if you suspect the housing has become pressurized.

Indication of a pressurized housing may include:

1. Water is squirting out from the pressure housing tube.
2. The pressure housing feels heavier than normal, indicating that the pressure housing may be flooded.
3. The pressure housing is hot or smoking.
4. You have difficulty removing the white plastic keeper rod, indicating pressure is forcing the end cap out against the plastic keeper rod.

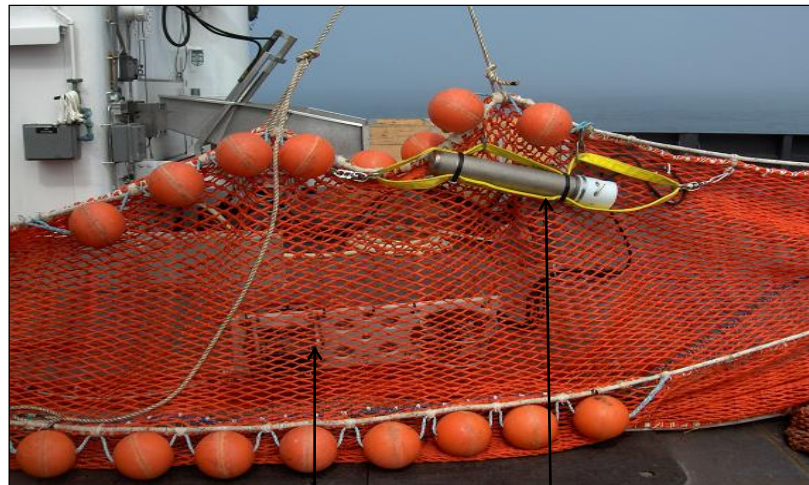
If you suspect that the pressure housing is pressurized keep all personnel clear of the pressure housing and keep the end cap positioned in a safe direction.

Do not approach or touch the pressure housing until you are satisfied that the internal pressure has returned to a safe ambient level. This may be impossible to determine.

The only way to release the internal pressure from this pressure housing is to remove the end cap. This should be done only by a trained and qualified individual.

The manufacturer of this pressure housing assumes no responsibility whatsoever for damage caused by the handling of this high pressure vessel.

Example of a Camera System in a Trawl Net



Pressure Housing Unit

Camera and Light Mounting Board



Image from a video camera system showing a Chinook salmon in route of escaping out a Pacific hake midwater trawl net that is using a salmon excluder.

Acknowledgements

Portions of this video system benefited greatly from previous designs developed by Scott McEntire at the Alaska Fisheries Science Center. Stan Tomich at the NW Fisheries Science Center developed one of the circuit boards currently in use. Katie Watson at the NW Fisheries Science Center critically reviewed this manual. The development and fabrication of the video system was funded, in part, by the NOAA Fisheries Bycatch Reduction Engineering Program.

Glossary of Terms

Molex Connector - term for a two-piece pin and socket wiring interconnection. In such a connector, cylindrical spring-metal pins fit into cylindrical spring-metal sockets. The pins and sockets are held in a rectangular matrix in a nylon shell. The connector typically has one or multiple circuits.